CHAPTER 7

ENDODONTIC ASSISTANCE

DENTAL SPECIALTY OF ENDODONTICS

Before major advances in the treatment of diseases of the dental pulp and periapical tissues were made, dentists extracted many teeth needlessly. Endodontics is the dental specialty primarily concerned with these diseases. In some dental clinics, an endodontist is assigned exclusively to this specialty. Often, some of the restorative dentists spend part of their time seeing patients who require endodontic treatment, also known as root canal therapy. As a basic dental assistant, you must be familiar with the following aspects of endodontics:

- Functions, causes, and diagnosis
- Types of procedures
- Steps in pulpectomy and root canal treatment
- Steps in apicoectomy and associated procedures

You must also be able to identify:

- Endodontic instruments
- Endodontic materials
- Endodontic equipment

When involved with endodontic procedures, you must follow BUMEDINST 6600.10, *Dental Infection Control Program*. Strict compliance to sterile technique, sterilization, and disinfection is absolutely essential in endodontic treatment.

FUNCTION

The primary purpose of endodontics is the treatment of diseases of the pulp and periapical tissues. The goal of this treatment is to retain the natural teeth rather than extract them. Often, the endodontic patient's initial appointment is of an urgent nature because of the associated pain or infection. Understanding the causes of pulp disease and how a diagnosis is reached will increase your ability to be an effective endodontic assistant.

CAUSES

The dental pulp can be injured in several ways. Some injured teeth can be treated and returned to normal. Other injured pulpal tissue may undergo necrosis (die) after the slightest injury. Some of the most common causes of injury to the pulp include dental caries (covered in *Dental Technician,* Volume 1, NAVEDTRA 12572, chapter 5, "Oral Pathology"), traumatic blows to the teeth, pulp exposure (covered in *Dental Technician,* Volume 1, NAVEDTRA 12572, chapter 6, "Emergency Treatment of Oral Diseases and Injuries"), chemical irritation, and thermal irritation.

Traumatic Blows

Traumatic blows to the teeth can result from situations such as common household accidents, auto collisions, or athletic injuries. A sharp blow to one or more teeth can result in fracture of the crown or root, or even the avulsion (forcefully knocked out of the socket) of the complete tooth, cutting off the blood flow to the pulp.

Chemical Irritation

Chemical irritation after placement of certain chemical substances commonly used in restorative procedures can cause pulp injury or death. Another cause of chemical irritation is a faulty restoration, which allows oral fluids to leak between the restoration and dentin.

Thermal Irritation

Thermal irritation can cause pulp injury and patients will experience discomfort when they inhale cold air through their mouths. If metallic restorative materials are placed close to the pulp, the patient w-ill experience thermal irritation.

DIAGNOSIS

The diagnosis of pulp and periapical conditions must precede the treatment. Endodontic diagnosis is a result of the skillful use and interpretation of several methods. Some of the more common methods are discussed in the paragraphs that follow.

Dental History

The patient's dental history is a valuable aid to the dentist. It provides communication between the dentist and the patient, and allows the dentist to trace the history of the complaint through symptoms described by the patient. Often, patients reveal valuable information regarding previous injuries to the teeth, even though they may have occurred many years earlier.

Clinical Examination

A clinical examination of the oral cavity allows the dentist to visually inspect the patient's mouth providing clues to the nature of the patient's problems. Such clinical signs as discoloration of the teeth, crown fracture, gross caries, swelling, abnormal soft tissue, and a draining abscess can be identified during a clinical examination.

Radiographs

Radiographs of the teeth and bone are one of the most valuable diagnostic tools the dentist has to evaluate structures that cannot be seen by clinical examination, such as the pulp and periapical tissues. The presence of bone loss in the periapical area in response to a necrotic pulp can be detected on a radiograph as a dark area surrounding the apex of the root. The presence of this dark area, or radiolucency, on a dental radiograph is an important feature used to diagnose pulp and periapical disease. Periapical pathology appears as radiolucencies on a radiograph.

Radiographs can also reveal possible causes of pulpal injury before bone resorption occurs. Root fractures, deep caries, and previous pulp exposures are some examples of possible causes of pupal injury detected on a radiograph. An accurate radiograph can reveal root length, abnormal root curvature, and abnormal calcification, which is helpful information in determining if the tooth can be treated endodontically. A radiograph, properly exposed and processed, can last indefinitely and provide a permanent record of the condition of the patient and be used for future reference. Comparison of the initial radiographs with postoperative radiographs is a valuable index to determine if the treatment was successful.

Pulp Testers

Two of the common pulp testers used primarily to determine whether the pulp is vital or necrotic (nonvital) are shown in figure 7-1. Electric current is used to stimulate nerve fibers in the pulp through the dentin layer. General information about the status of the pulp is obtained by comparing the response of a suspected tooth with that of a normal tooth (control tooth) of the same type on the opposite side of the mouth. The amount of current delivered to a tooth is indicated by a numerical scale. The patient holds the ends of the probe to complete the circuit. Higher numbers on the scale indicate that more current is delivered to the tooth. As the current is increased gradually, the patient is instructed to let go of the probe whenever a sensation is first detected within the tooth.

Generally, the sensation is described as a slight tingling or warm feeling. The number at which a response occurs is recorded and compared with the test results of the control tooth. A tooth with a necrotic pulp will not respond to even the most intense electrical stimulation. A dying pulp can produce a variety of responses, depending on the state of the pulp at the time of the test. However, the number readings are relative and cannot be used to diagnose vital pulp.

Thermal Sensitivity Test

The thermal sensitivity test exposes a tooth to extremes in temperature and provides an accurate method of identifying the problem tooth, as well as determining the status of its pulp. The two most common diagnostic tests are cold and heat.

COLD TEST.—The cold test can be done easily by placing a cylinder or stick of ice on the tooth. First, the suspected tooth is isolated and dried, then the ice stick, held in a gauze square, is applied to the cervical area of the tooth. Healthy teeth will respond positively to a cold stimulus, but the sensitivity should resolve quickly. If the pulp is inflamed, the patient will

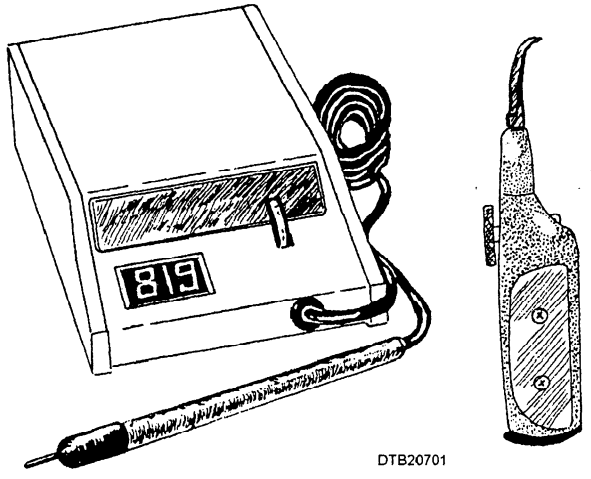


Figure 7-1.—Two common pulp testers.

experience a lingering sensation to cold. Other cold test materials that can be used are ethyl chloride and skin refrigerants.

HEAT TEST.—The heat test consists of isolating the suspected tooth with a rubber dam and applying a warm liquid (hot water or coffee) to the tooth. The warm liquid should not be hotter than 140°F and should not burn your skin. If the tooth reacts with a painful response that lingers a few seconds after the heat is removed, **pulpitis** may be present. If the patient experiences a violent pain reaction to the heat and is relieved by a cold application, the pulp is irreversibly inflamed and will need a root canal. If the patient experiences no response to heat or cold, the pulp is necrotic.

Percussion

Percussion is the gentle tapping of the crown of the tooth with the finger or the end of a mirror handle to determine the presence of periapical inflammation. If a patient has an acute inflammation at the apex of the root, percussion stimulates the already inflamed area and pain results. An abnormal dull sound may signify a root that has attached to the bone. Several normal, opposing, and adjacent teeth should be checked for comparison.

Palpation

Palpation is the application of the finger with light pressure to areas of the mouth to detect normal or abnormal tissue. Swelling, pain, and degree of rigidity of tissues are determined by palpation. When using palpation in the diagnosis of periapical diseases, the fingers are pressed gently against the soft tissue overlying the bone and apexes of the teeth to compare the tissues.

Mobility Test

The mobility test is done by moving the tooth between the handles of 2 instruments. Abnormal mobility of a tooth when compared to healthy teeth signifies temporary or permanent loss of supporting alveolar bone or trauma. Mobility of the tooth tends to increase if an infection or injury is long standing and has affected the supporting periodontium tissues.

Selective Anesthesia

Selective anesthesia can be of assistance if the patient cannot accurately determine which teeth are the source of discomfort. If other diagnostic tests have narrowed the choice down to two teeth, one tooth can be anesthetized to determine if the pain disappears. If the pain does not disappear until the second tooth is anesthetized, the second tooth is the probable source. Selective anesthesia is most effective when the choice is between a maxillary and a mandibular tooth.

Transillumination

Transillumination uses fiber optic lighting to allow an intense, concentrated light to pass through the tooth from the lingual to the facial aspect. This is done most effectively on anterior teeth because of their structure and location in the arch. The light transmits through the enamel and dentin, permitting the detection of caries or a fractured crown.

TYPES OF PROCEDURES

There are several types of endodontic procedures. The more common procedures include pulp capping, pulpotomy, pulpectomy, and root canal therapy. Occasionally other procedures such as incision and drainage, apicoectomy, periapical curettage, retrograde filling, root amputation, and bleaching of teeth are indicated.

PULP CAPPING

In an attempt to protect the pulp against additional injury and stimulate pulp regeneration, an application of protective dressing, such as calcium hydroxide, is placed over an exposed or nearly exposed vital pulp. This treatment is referred to as **pulp capping.** When the pulp is exposed mechanically during tooth preparation, placing a pulp cap directly over the exposed pulp is referred to as a **direct pulp cap.** If deep caries are present and a danger of exposing the pulp exists, placing a pulp cap over a layer of remaining dentin is termed an **indirect pulp cap.** If pulp capping in not effective, the pulp can be treated with endodontic therapy.

PULPOTOMY AND PULPECTOMY

A *pulpotomy* is the surgical removal of the coronal part (pulp chamber) of an exposed vital pulp. The pulp is retained in root canals with the exposed ends covered with applications of calcium hydroxide, zinc oxide and eugenol, and zinc phosphate cement to preserve its vitality and function. If indicated, root canal treatment is completed at a later date.

The most common endodontic procedure is the *pulpectomy*, which is the removal of the entire pulp (chamber and canal). After removal of the pulp, root canal therapy is performed.

ROOT CANAL THERAPY

This treatment consists of the internal debridement, cleaning, shaping, and permanent filling of the root canal system. During the therapy, the dentist may place medications and temporary filling material. The therapy may vary slightly because of the type of tooth and number of canals in the tooth.

INCISION AND DRAINAGE

An acute periapical abscess may indicate a need for incision and drainage to eliminate the infection along with endodontic treatment. Incision and drainage can be effective when the swelling and infection are localized in the alveolus with a clearly defined point on the surface of the mucosa. Endodontic treatment Should be initiated at the same appointment to remove the necrotic infected pulp. Although the periapical abscess usually is accompanied by severe pain, it is not advisable to inject a local anesthetic solution directly into the infected area when draining the abscess because of the danger of spreading the infection. Instead, block anesthesia and infiltration away from the infected area. Local anesthesia may not be as effective because of changes in the pH of the tissues in the presence of the infection. The patient must be informed to expect momentary discomfort when the area is lanced, but the pain is immediately and significantly reduced after the incision is made and the exudate (pus) is expressed. If indicated, a drain is placed to provide short term drainage and to prevent the opening from closing prematurely until the infected area drains. The dentist may prescribe antibiotics. Once the infection is controlled and the swelling and tenderness subside, the dentist will treat the tooth endodontically.

APICOECTOMY AND PERIAPICAL CURETTAGE

An *apicoectomy* (root end resection) is the surgical removal of the apical portion of the tooth through a surgical opening made in the overlying bone and gingival tissues. An apicoectomy usually is performed in conjunction with periapical curettage after the body fails to heal after endodontic treatment. *Periapical curettage* is the surgical removal of apically inflamed tissue associated with the tooth through an opening made in the overlying bone and gingival tissues. Treatment is limited to curettage of the area to remove all diseased material. Conditions that may indicate the need for an apicoectomy include:

- Persistent, local infection following endodontic treatment.
- Canal filling materials or medications extruded into the periapical tissue.
- A broken instrument lodged in the canal preventing complete filling.
- Obstruction caused by a calcified root canal.
- Extreme curvature of the canal preventing access to the apex of the root.
- Root canals that are unfilled or debrided.

RETROGRADE FILLING

This is a method of sealing the apical end of the root canal by placing a restoration in the root apex. This is usually done in conjunction with the apicoectomy. Superortho-ethoxybenzoic acid (EBA) cement or an intermediate restorative material such as Zinc Oxide and Eugenol (ZOE) is used as the filling material because they will not react with any moisture that may be present in the root canal. Some dentists prefer to use composite filling material.

ROOT AMPUTATIONS

Occasionally, a multirooted tooth requiring endodontic treatment may have a root that is impossible to obtain an adequate apical seal or is affected by periodontal disease. When the other roots of the teeth are treatable, rather than extracting the entire tooth, the untreatable root is amputated and removed. The opening to which the amputated root was attached is sealed with amalgam similar to that of an apicoectomy procedure. The retained section of the tooth is treated endodontically before amputation.

BLEACHING OF DISCOLORED TEETH

The use of chemical agents may be used to remove discoloration from the crowns of vital or nonvital teeth. Nonvital teeth may discolor because of pupal hemorrhage into the dentinal tubules after traumatic injury of the tooth, or from the use of medications that cause staining when used in endodontic therapy. In such cases, the appearance of the discolored teeth may be improved dramatically by bleaching the tooth.

STEPS IN PULPECTOMY AND ROOT CANAL TREATMENT

As in all efficient assisting, you will need to anticipate the dentist's needs. In endodontics, your duties consist of such tasks as performing infection control procedures, preparing for the treatment, aiding in the placement of the rubber clam, irrigating and aspirating to flush the area, mixing materials, and passing instruments. You will need to have knowledge of the treatment procedure and sequence to effectively anticipate the dentist's needs and to schedule appointments.

APPOINTMENT SCHEDULING

Root canal therapy may take one or more appointments based on the number of canals and severity of infection. Before a canal can be filled, the canals must be completely cleaned. Filling the canal while infective organisms are still present may result in non-healing. A patient suffering from an acute periapical abscess may experience severe pain. The pain is due to inflammation in the pulp canal, and/or periapical tissues. The pressure, and therefore the pain, is relieved during the first step of endodontics when the pulp canal is opened. Once the pulp canal is opened, broaches can be used to remove intact pulp tissue from the canal. The canal is then irrigated, and debrided with files and reamers. Dry the canal and place small medicated cotton pellets into the pulp chamber to help clear up the infection. Then, the dentist may place a temporary restoration.

During a second appointment, if necessary, the temporary restoration is removed, the canals irrigated, and root canal reamers and files are used to enlarge, shape, and smooth the pulp canal. If infection continues to be a problem, placement of medication into the canal, and placing a temporary restoration will be required. Schedule the patient for another appointment. When all instrumentation is complete and infection is eliminated, gutta-percha is placed into the canals with a sealer that acts as a cement. Then a temporary restoration can be placed.

After root canal treatment is completed, a permanent restoration is placed, usually at a later appointment. At this time, the tooth may be evaluated for possible prosthodoiltics treatment to replace the restoration with an artificial crown.

During all appointments, use a rubber dam to isolate the tooth, prevent contamination of the root canal, and prevent the small endodontic instruments from going down the patient's throat.

ENDODONTIC MATERIALS

The main materials used in root canal therapy are various liquid antiseptics, paste, paper points, gutta-percha points, and sealers. The dentist uses these to treat and fill a properly prepared root canal from which the pulp has been removed.

Paper Points

Paper points are primarily used during the treatment phase of endodontics to dry out root canals. They are highly absorbent, rolled sterile paper that are long and narrow with a tapered point to fit into the root canal. Paper points are available in assorted sizes, from coarse to X-fine, depending on the size of the canal into which they are being inserted.

Root Canal Restorative Materials

Root canal restorative materials are used to fill the previously prepared root canals and complete the root canal or endodontic therapy. Root canal restorative materials consist of tapered gutta-percha points in a variety of sizes and root canal sealers or cements. A good root canal restorative material should be insoluble in tissue fluids, opaque to the passage of X-rays, easy to remove, nonirritating to periapical tissues, nonabsorbent, and dimensionally stable after its insertion into a root canal.

GUTTA-PERCHA.—Gutta-percha is used as a temporary restoration and as a root canal restorative material. Gutta-percha is the refined, coagulated, milky exudate of certain trees. It is pink or gray in color, softens when heated, and is easily molded. When it is cool, it maintains its shape well. Gutta-percha points have been a choice for root canal restorative materials for many years. The many advantages of the material are as follows:

- High thermal expansion
- Will not shrink unless used with a solvent
- Radiopaque
- Can be kept sterile in an antiseptic solution
- Resistant to moisture and bacteriostatic
- A poor heat conductor

The disadvantages of gutta-percha are as follows:

- Shrinks when used with a solvent
- Is not always easily inserted into the root canal

Gutta-percha points are prepared for insertion by disinfecting them in sodium hypochlorite. They are then air dried, condensed, compacted and inserted into the root canal after the canal walls are coated with sealer.

TEMPORARY FILLINGS.—Temporary filling is a temporary restorative material used to seal the access cavity in the tooth between appointments. It may be a commercially available material packaged in a tube, or an intermediate restorative material such as ZOE.

ROOT CANAL SEALERS.—The root canal sealers most commonly used in dentistry are packaged in cement and paste form. The zinc oxide and eugenol type is the cement most often used. The liquid eugenol, and a typical zinc oxide powder formula may contain several ingredients as follows:

- Zinc oxide-main ingredient
- Resins-vegetable or mineral oil types
- Anhydrous sodium borate
- Bismuth subcarbonate or subnitrate

Besides the main ingredients, some formulas contain silver particles or barium sulfate, which add radiopaque (ability to stop radiant energy such as X-rays) qualities. These ingredients are mixed in much the same way as in zinc phosphate cement. Using a sterile glass slab and noncorroding spatula, incorporate the powder into the liquid until a thick, creamy consistency is reached.

INSTRUMENTS AND ACCESSORIES

Endodontic instruments and accessories often are prepared in sterile packs or kits. A basic instrument setup can be established for endodontic procedures. The standardized setup can be used during each phase of treatment and supplemented with items needed for a specific phase of treatment. Items that make up a rubber dam setup must be included since the rubber dam is essential to provide isolation and maintain a sterile field. Figure 7-2 illustrates a typical instrument endodontic tray setup. Small endodontic instruments and supplies are generally placed in a metal compartmentalized box that can be sterilized and maintained in an orderly fashion. Figure 7-3 identifies such an example and figure 7-4 list the contents. A variety of accessory items, such as instruments, filling materials, irrigation solutions, cements, and medications used in the endodontic treatment must be readily available during the procedure.

Endodontic Explorers

Endodontic explorers (fig. 7-5) have long, narrow working ends. These explorers are angled from their shank in such a way that they provide easy access to the pulp canal. They are used to locate canal openings and explore the pulp chambers and canals.

Endodontic Cotton Forceps

These instruments resemble the cotton forceps. The major difference is that the endodontic cotton forceps are grooved to allow easy grasping and manipulation of paper points and gutta-percha. They are also available in locking or nonlocking design.

Endodontic Excavators

These instruments are long, double-ended spoon excavators designed for endodontic treatments. They allow the removal of coronal pulp tissue, caries, or cotton pellets that may be deep in the tooth's crown

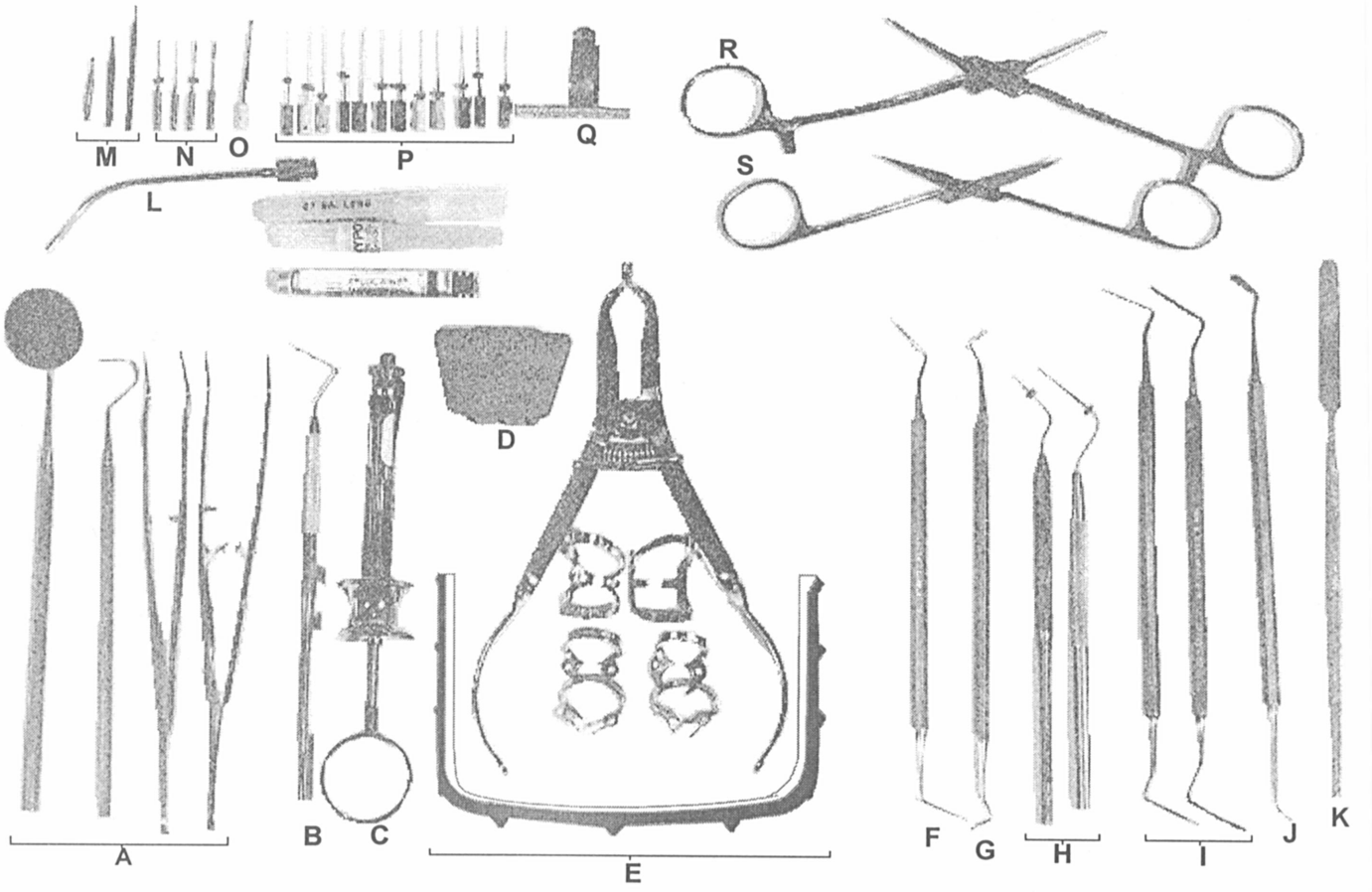
Broaches

A root canal broach (fig. 7-6) is usually one of the first instruments used in the pulp canal during endodontic treatment. Broaches are thin, flexible, usually tapered and pointed, smooth or with a series of sharply pointed barbed projections curving backward and obliquely. The identification symbol of barbed broaches is an eight-pointed star formed by the barbs.

Smooth broaches can be used as explorers to get the feel of the canal. A barbed broach is used primarily for the removal of intact pulp tissue from large canals. The broach is introduced slowly into the root canal until gentle contact with the canal walls is made. It is rotated 360 degrees in either a clockwise or counterclockwise manner to entangle the pulpal tissue in the protruding barbs. It is then withdrawn directly from the root canal. If successful, the entire pulp comes with it. Because these instruments are fragile and prone to breakage, exercise great care in their use. There are several sizes: coarse, medium, fine, X-fine, XX-fine and XXX-fine. Discard each broach after each use.

Reamers

Root canal reamers (fig. 7-7) are used to enlarge the pulp canal after broaches have been used. Reamers may be used with a reaming action (rotary cutting) or a filing action (scraping or pulling stroke). Reamers are



A. MOUTH MIRROR,EXPLORER,COTTON FORCEPS,LOCKING COTTON FORCEPS
B. PERIODONTAL PROBE
C. ANESTHETIC SYRINGE,CARPULE AND NEEDLES
D. MOUTH PROP
E. PLASTIC TYPE RUBBER DAM FRAME, FORCEPS AND CLAMPS
F. ENDODONTIC EXPLORER
G. SPOON EXCAVATOR
H. CANAL SPREADERS
I. CANAL CONDENSERS (PLUGGERS)
J. WOODSON,#2
K. SPATULA
L. SUCTION TIP
M. BURS
N. GATES-GLIDDEN DRILLS
O. BROACH
P. K-FILES
Q. ENDO RULER
R. HEMOSTAT
S. IRIS SCISSORS

Figure 7-2.—Typical endodontic instrument tray setup.

usually tapered and pointed, with spiral cutting edges. Since the cutting edges of reamers are farther apart then those found on files, reamers are more flexible than files. This same distance between the cutting edges causes reamers to cut slower than files. Reamers can also be used to remove old, softened gutta-percha filling, or as a paste carrier to place cement near the apex.

Reamers are available in many sizes beginning with size 10 and continuing in intervals of 5 to size 60. Beginning with size 60, they are also available in intervals of 10 through size 140. The dentist may use several reamers in one operation, usually beginning with a relatively small size, then the next larger size each time the canal has been reamed to the desired diameter.

Files

Root canal files normally are used after the broaches and reamers. The root canal files look much like those of the reamers. However, the file threads or cutting edges are much finer and closer together. Files come in two different types (H and K types) and are different in terms of physical properties, such as flexibility, resistance to fracture in rotation, and method of manufacture. The designation of "K-type"

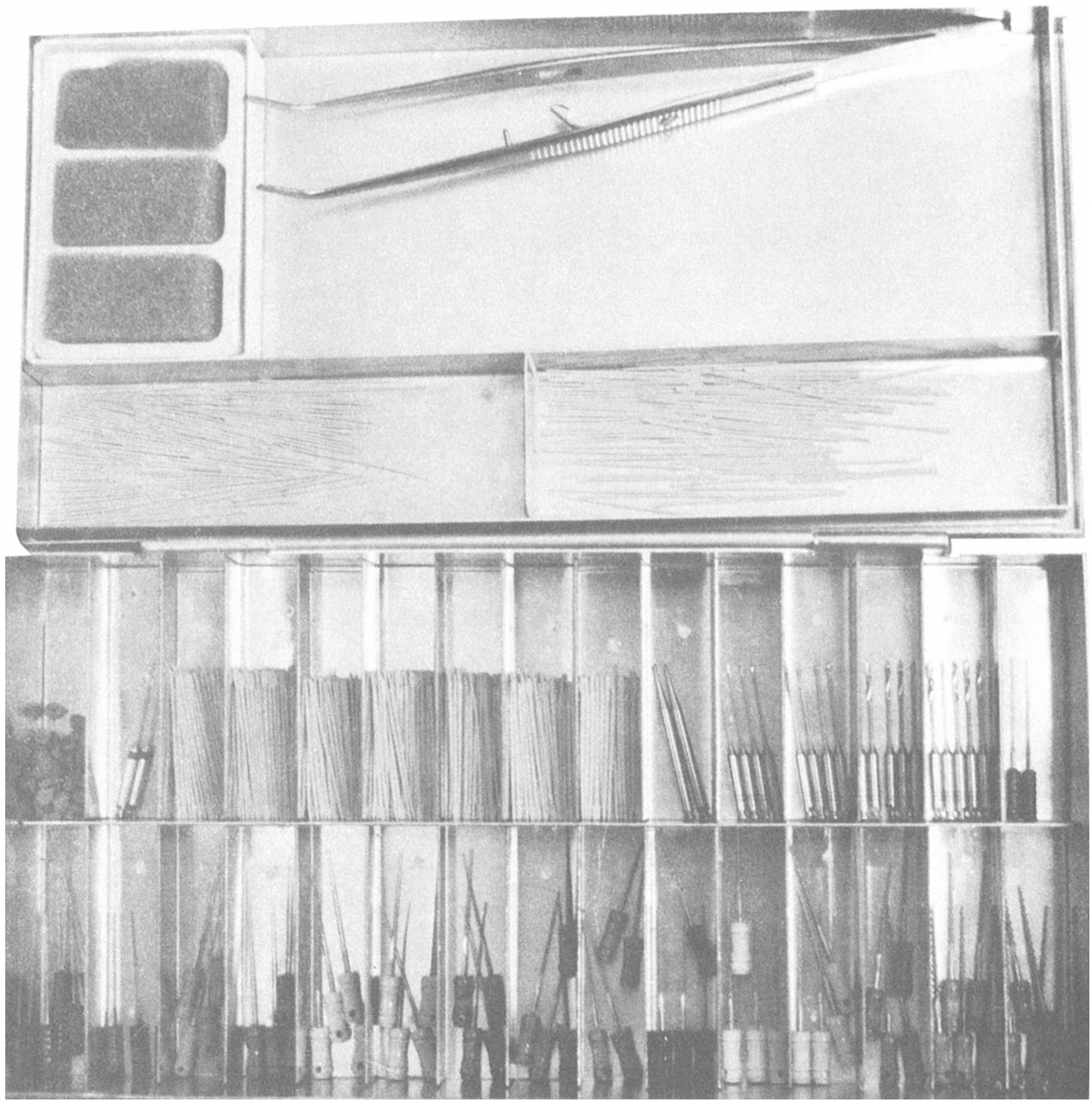


Figure 7-3.—Typical enclodontic box kit with supplies.

or "H-type" is a generic classification based on a manufacturing process and does not apply to any single design or line of instruments.

Numerical size designations and color coding are the same for both file types. Sizes begin with size 8 and continue through size 140. Files come in different lengths, including 19 mm, 21 mm, 25 mm, and 31 mm.

K-Type.—The K-type is tapered and pointed, with tight spiral cutting edges arranged so that the cutting occurs on either a pushing or pulling stroke. They are used to enlarge the root canal by a rotary cutting or abrasive action. When pulling the instrument out of the tooth, the cutting edges scrape against the wall, gouging and removing dentin in a filing action. When the instrument is turned in a

MEDIUM BROACHES	SILICONE STOPS
COARSE BROACHES	LENTULO SPIRALS
#8 FILES	#35 GUTTA PERCHA
#10 FILES	#40 GUTTA PERCHA
#15 FILES	#45 GUTTA PERCHA
#20 FILES	#50 GUTTA PERCHA
#25 FILES	#55 GUTTA PERCHA
#30 FILES	#60 GUTTA PERCHA
#35 FILES	#70 GUTTA PERCHA
#40 FILES	#2 ROUND BURS
#45 FILES	#2 GATES DRILLS
#50 FILES	#3 GATES DRILLS
#55 FILES	#4 GATES DRILLS
#60 FILES	#5 GATES DRILLS
#70 FILES	X-FINE BROACH

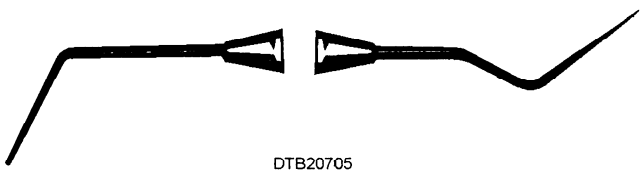
#25 GUTTA PERCHA	#30 GUTTA PERCHA
	COTTON PLIERS
#30 GUTTA PERCHA	

INVENTORY LEVELS

SILICONE STOPS	50	#2 LONG SHANK ROUND BURS	10
#25 GUTTA-PERCHA POINTS	50	#2,3,4&5 GATES-GLIDDEN DRILLS	10
#30 GUTTA-PERCHA POINTS	100	BROACHES (X-FINE,MEDIUM&COARSE)	10 EACH
#35 GUTTA-PERCHA POINTS	50 EACH	FILES: #S 8-70	10 EACH

DTB20704

Figure 7-4.—Items and inventory levels of endodontic box kits.

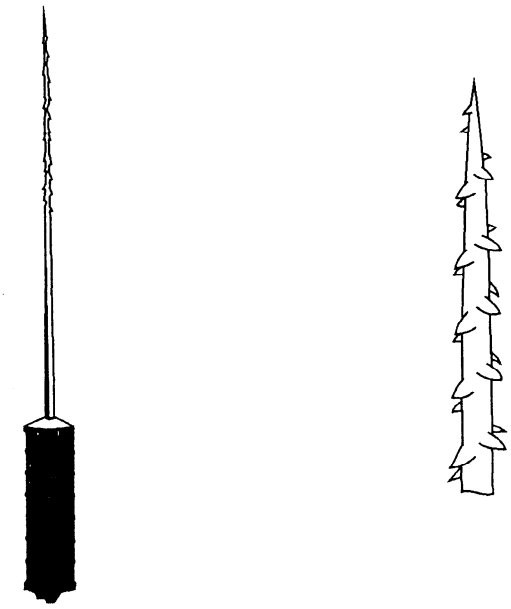


DTB20705

Figure 7-5.—Endodontic explorers.

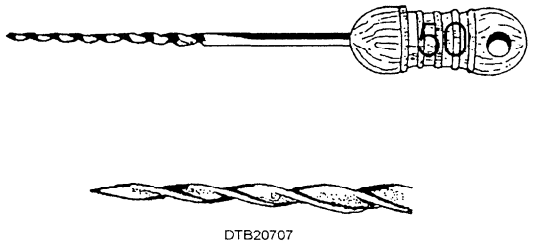
clockwise, rotary action, the cutting edges scrape the wall and widen the preparation in a reaming action. K-type root canal files (fig. 7-8) are, size for size, stiffer and stronger than comparable types of files. The identification symbol for K-type files is a square.

H-Type.—The H-type are tapered and pointed, with spiral cutting edges arranged so that cutting occurs principally on the pulling stroke. These files also know as "Hedstrom" (fig. 7-9) are used to enlarge the root canal by either a cutting or an abrasive action. The series of intersecting cones forming the file become successively larger from the tip toward the handle. The sharp blades of the H-type files cut more quickly than reamers or K-files. The H-type files are frequently used for flaring of the canal from the apical region to the occlusal or incisal opening. The identification symbol for H-type files is a circle.



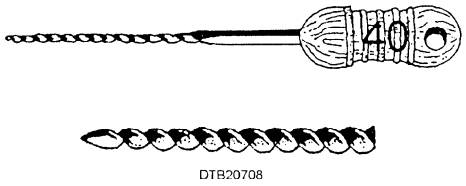
DTB20706

Figure 7-6.—Root canal broach with enlarged view.



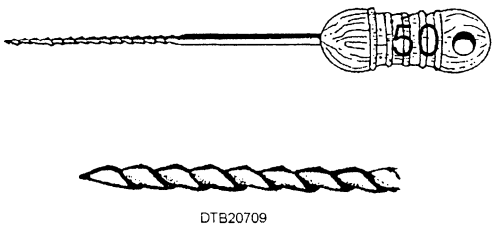
DTB20707

Figure 7-7.—Reamer with enlarged view.



DTB20708

Figure 7-8.—K-type file with enlarged view.

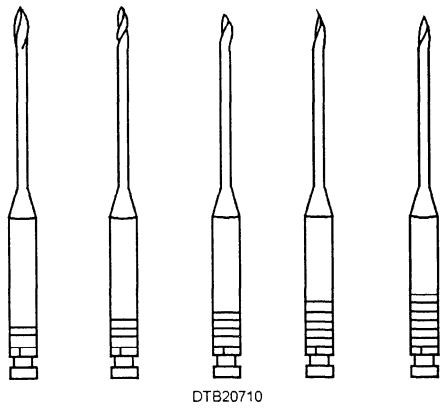


DTB20709

Figure 7-9.—H-type file with enlarged view.

Gates-Glidden Drills

Gates-Glidden drills (fig. 7-10) are designed to enlarge the root canal. They are designed with long flame-shaped shanks. As a rotary cutting instrument, they call be used with a slow-speed contra-angle and with friction-grip straight handpieces. The number of bands at the base of the drill indicates the size of the drill. Their sizes are numbered 1-6. Size #1 is fragile and therefore rarely used to avoid the possibility of breaking off inside the canal.



DTB20710

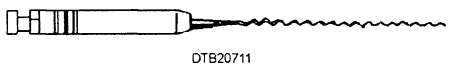
Figure 7-10.—Gates-Glidden drills.

Lentulo Spiral

The lentulo spiral (fig. 7-11) is designed to transport cement or paste to the finished root canal before the placement of the gutta-percha master cone. It is used with a latch-type handpiece and is small and flexible in design.

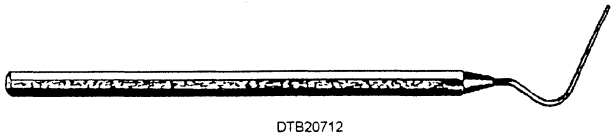
Endodontic Condensers

There are two types of endodontic condensers. The first type is referred to as a **plugger** or **vertical condenser.** The working end is contra-angled, and cylinder-shaped with a flat tip designed to condense root canal filling materials vertically into prepared root canals. The plugger shown in figure 7-12, has serrations at 5-mm intervals to evaluate penetration depth.



DTB20711

Figure 7-11.—Lentulo spiral.



DTB20712

Figure 7-12.—Root canal plugger or vertical condenser.

The second type of endodontic condenser is called a **spreader.** The root canal spreader (fig. 7-13) has a contra-angled working end that tapers to a point (compared to the flat tip of a plugger). This instrument is single ended. Spreaders are designed to condense root canal filling materials horizontally against the wall of the prepared root canal.

Finger spreaders and finger pluggers have a handle like a file and a smooth working end like a spreader or plugger. The finger spreader has a pointed end, the finger plugger has a flat end.

Endodontic Measuring Gauges

Precise measurements of the length of a root canal are vital to the success of root canal therapy. The dentist uses a measuring gauge to measure the working length of files, reamers, and broaches. Two styles of measuring gauges are commonly used. The first type is shown in figure 7-14. The finger or thumb ruler is the other type used. The exact working distance can be set on the bar and is confirmed when the end of the instrument reaches the metal plate. The example in fig. 7-14 shows the working distance of a file set at 21 mm.

Stops

Stops (fig. 7-15) are small, round or square pieces of rubber, plastic, or silicone placed on the files, reamers, or broaches to mark the length of the canal. This prevents injury to the apex of the root and periapical tissues.

ANESTHESIA AND PAIN CONTROL

A local anesthetic must be administered by the dentist before endodontic therapy if the tooth is vital. If the tooth is hypersensitive, it may require injection of additional solution directly into the pulp. When a tooth is nonvital, the use of local anesthetic solution is not mandatory. At subsequent visits, after the pulp has been removed, local anesthesia may not be necessary. The dentist may give the patient a prescription for medication to control any anticipated postoperative discomfort or infection.

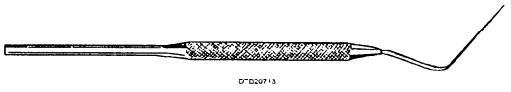


Figure 7-13.—Root canal spreader.

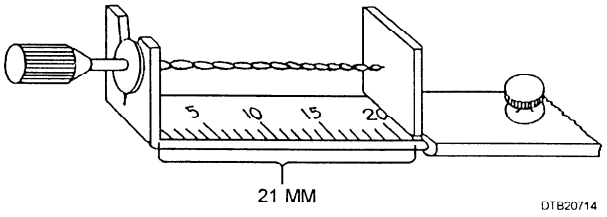


Figure 7-14.—Measuring gauge.

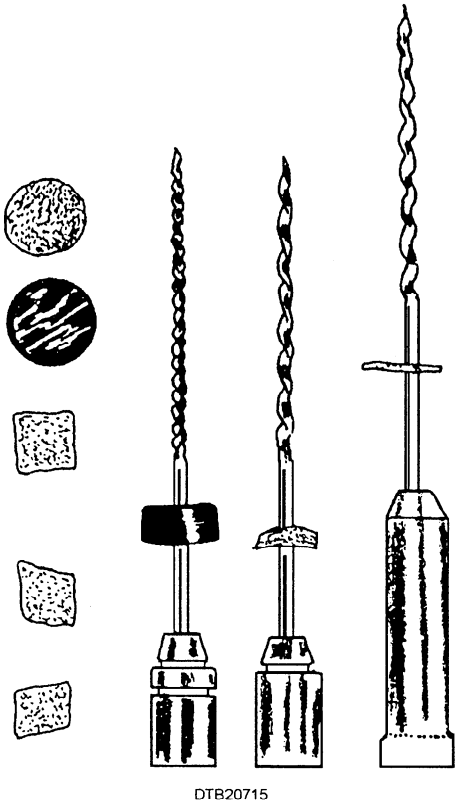


Figure 7-15.—Stop attachments.

ISOLATION

Endodontic therapy involving the removal of the pulp and sealing the empty canal requires debridement, irrigation, and sterilization of the pulp chamber and canals as part of the procedure. These steps of the procedure are necessary to ensure against future infection by eliminating bacteria before the canal is sealed. An absolutely dry field, free from bacteria-laden saliva is required to achieve such sanitation of a root canal. Additionally, the rubber dam prevents patients from swallowing or aspirating the very small instruments used in endodontic treatment. This dry field is maintained best with a rubber dam isolation. The rubber darn usually is prepared to expose only the tooth to be treated endodontically, thereby providing isolation of the tooth with the rubber dam. A radiolucent rubber dam frame made of plastic is

commonly used and saves valuable time when exposing radiographs. Metal rubber dam frames must be taken off while exposing radiographs. Remember a risk of contamination can occur while the frame is off.

OPENING THE PULP CHAMBER AND CANALS

After the tooth is isolated, the dentist makes an opening through the crown of the tooth to gain access to the pulp chamber and canal. The opening is made through the lingual surface on anterior teeth (fig. 7-16, A) and through the occlusal surface on posterior teeth (fig. 7-16, B). Friction-grip and latch-type burs or diamond stones are used to create the endodontic opening. Sizes vary according to the preference of the dentist and the size of the chamber and canals of the tooth.

REMOVING THE PULP

After the endodontic opening is made, the dentist will locate the root canals and remove the pulp. Anterior teeth usually have one root canal, but often lower incisors will have two canals. Posterior teeth may have up to four canals of different sizes. Anatomical variations exist among patients; therefore, additional canals may be found. A thin, straight explorer can be used as a probe to locate canal openings within the pulp chamber. The larger pulp canals are easier to locate; whereas, smaller canals are sometimes difficult to locate.

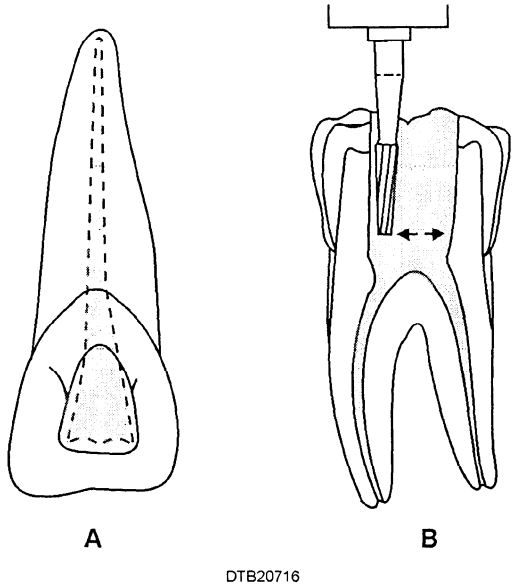


Figure 7-16.—Access to pulp chamber and canal: A. Anterior teeth; B. Posterior teeth.

Once the canals are located, the pulp tissue must be removed. If the pulp tissue is still intact, the thin, flexible, barbed broach is used to remove it. Broaches are considered disposable and should be discarded after one use, since they are subject to fracture after repeated sterilization. If the pulp tissue has disintegrated, it is simply removed when the canal is cleaned and filled.

IRRIGATION

After the root canals are accessed and the pulp tissue is removed, the root canals are cleaned with an irrigating solution. Irrigation and evacuation are essential parts of endodontic treatment because they assist in the removal of pupal remnants and tissue fluids. The irrigation solution also serves as a lubricant in the instrumentation and enlargement of the canal walls.

The most frequently used solution for irrigation of the root canal is **sodium hypochlorite** or common household bleach. This solution is a solvent for necrotic tissue, in effective disinfectant to destroy bacteria in the canal, and acts as a bleaching agent. Sodium hypochlorite may be used full strength or diluted with 1 to 2 parts water to reduce the chlorine odor.

A sterile, disposable, plastic Luer lock-type syringe (5 cc to 10 cc sizes) with a disposable, blunt 20 to 27 gauge needle is the comnon instrument used to inject the irrigating solution into the canals. The needle may be bent at an angle to provide access to the canal.

The irrigating solution is injected slowly and gently into the canal to prevent the solution from being forced into the periapical tissue. A small root canal file or reamer can then be placed into the canal and rubbed against the pulp canal walls to produce a scrubbing effect that loosens debris and bacteria. The solution is removed with a suction tip on the oral evacuator. Any remaining solution may be absorbed by placing sterile cotton pellets and paper point into the canal. There are numerous times during endodontic treatment in which you will be required to provide thorough irrigation of the pulp chamber and canals. The following are the most common:

- Before the use of intracanal instruments once the root canal is accessed and the pulp tissue is removed.

- Before the instrumentation of a previously opened pulp cavity to remove food particles and saliva.
- At intervals during instrumentation, often after each size file is used.
- At the completion of canal instrumentation, before placement of medication.
- When using root canal preparation type.

CANAL CLEANSING AND SHAPING

Canal cleansing and shaping is the progressive elimination of organic and inorganic debris within the root canal by mechanical instruments. As part of the cleansing process, the canals are enlarged and shaped with **endodontic files and reamers.** Filing shapes the walls of the root canal so that they are smooth with specific size and shape.

The filing procedure begins by first establishing the approximate or estimated **length** of the root canal. Accurately determining the length of the tooth is vital to successful endodontic treatment. Failure to determine an accurate length may lead to apical perforation and overextension, with increased postoperative pain or incomplete instrumentation and underfilling.

The estimated length is determined from an accurate, preoperative periapical radiograph of the tooth being treated. Multirooted teeth may require radiographs from various horizontal angulations to determine the exact number and alignment of each root. The length of the tooth is measured using either an endodont ic millimeter ruler (fig. 7-17) or a file held near the radiograph from a reference point on the crown portion of the tooth to the apex. Good reference points are the incisal edges of anterior teeth and cusps on posterior teeth. Files are measured on a millimeter ruler and marked accordingly with the placement of rubber stops. The estimated working length is recorded in the patient record for future reference and modification. If necessary, a more accurate length is established as the filing process continues. The working length is verified by exposing and measuring a periapical radiograph with a reamer or tile in the canal. Once the tooth length is established, you will use an endodont ic gauge to adjust the position of the rubber stops on the appropriate sizes of reamers and the files the dentist selects. It is important that the rubber stops be placed at a right angle to the long axis of the instrument and not an oblique angle. When the file is inserted into the root canal, the rubber stop touches the reference point on the crown when the tip of the file is at the apex of the root. With the stops in place, arrange the reamers and files in order of their use. As the filing progresses, the file sizes are increased to enlarge the size of the canal. When teeth with more than one canal are filed, it is essential that each canal be filed to a predetermined length. Occasionally, an electronic apex locator may be used to help verify the working length. Each canal can be filed to different diameters, as well as, different lengths.

During the filing, the root canal is irrigated with solution to keep the dentin shavings from the canal walls from clogging the cutting edges of the file. After the filing is complete, the canal is thoroughly flushed simultaneously with irrigating solution and suction. The canal is dried with paper points held in locking forceps and inserted into the canal to absorb the solution. This is repeated with several paper points until the paper points are completely dry when withdrawn.

MEDICATIONS

After the root canal is dried with paper points, medications are occasionally placed in the canal between appointments to aid in the control of microbial activity within the tooth. A small cotton pellet is moistened with medication and blotted dry with a cotton roll or gauze. The small dry medicated cotton pellet is placed on the floor of the pulp chamber (fig. 7-18) over the opening on the canal and covered with a larger, dry cotton pellet. More often, only a dry cotton pellet with no medication is placed, or a paste of calcium hydroxide is placed into the canals before the dry cotton pellet is placed. A temporary filling must be placed over the larger cotton pellet to prevent contaminating the root canal with saliva and food

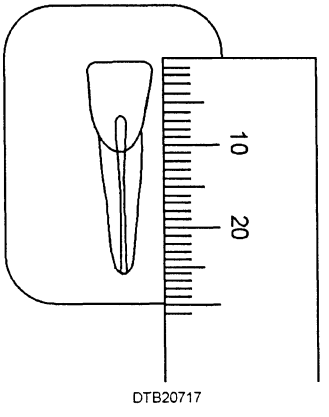


Figure 7-17.—Estimated working distance using an endodontic millimeter ruler.

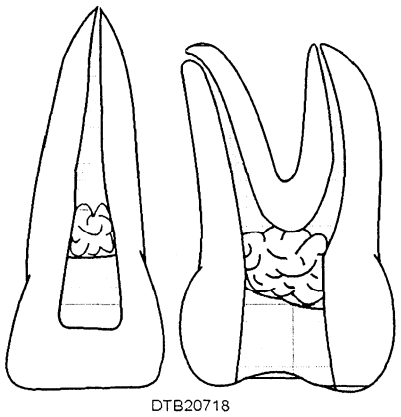


Figure 7-18.—Placement of dry medicated cotton pellet.

debris between appointments. Amalgam, zinc oxide and eugenol (ZOE), or. a commercially ready-made cement may be used for this purpose.

ROOT CANAL FILLING

If a medicated cotton pellet or temporary filling materials have been placed, these items must be removed and the canals irrigated and dried with paper points before proceeding to fill the root canal. Gutta-percha points or cones, available in various sizes are the most common filling material for a prepared root canal.

An appropriate sized gutta-percha point is selected and may be shortened slightly to blunt the tip. The point is placed into the canal to a depth where the point seems snug when gently tugged. This point is referred to as the **master cone.** A radiograph with either the apical tile, or master cone point in place is exposed to verify the proper length. The tip of the master cone should provide an adequate seal of the apical foreman. This radiograph often is referred to as a master cone radiograph. If adjustments are needed to achieve the proper length of the master cone, additional radiographs may be exposed to verify the propel length. A properly titted master cone also allows space between the point and the walls of the prepared canal. Before the master cone is removed, a slight mark is placed on the point at the line where it is even with the opening of the tooth by squeezing the cotton forceps on the gutta-percha. The master cone is now ready for cementing.

Mix the cement according to the manufacturer's instructions. The master cone is removed and a paper point is placed in the canal to absorb moisture that may accumulate. The consistency of the cement should be creamy but quite heavy. The dentist may choose to dip a lentulo spiral or reamer into the cement mix, insert it approximately halfway into the canal, and rotate it to distribute the cement onto the dry walls of the canal. With the master cone placed into the cotton pliers, the apical third of the cone is coated with cement. The cone is then inserted into the canal and seated to the mark made on the cone.

The space between the cemented master cone and the walls of either the root canal or pulp chamber is tilled with additional gutta-percha points (accessory cones) of smaller diameter alongside the master cone. Filling the canal with additional gutta-percha points is done by inserting an endodontic spreader beside the master cone and applying lateral pressure to condense the cone against the walls of the canal. As the spreader is removed from the canal, a smaller additional gutta-percha point in inserted in the space. The process of lateral condensation and addition of gutta-percha points continues until the canal is filled completely. Figure 7-19 illustrates the steps in filling a root canal with the master and accessory cones.

The excess length of gutta-percha is removed with a heated instrument. An endodontic plugger, also known as a vertical condenser, is used to condense the still warm gutta-percha vertically toward the apex of the tooth. More gutta-percha can be added if needed, and the process of vertical condensation continued until the canal is filled completely.

When a tooth has more than one root canal, each canal is filled individually and each requires a properly fitted gutta-percha point sealing in it. A perfect sealing of the apical foramen in the roots of the teeth is essential to eliminate irritation of periapical tissue. Any excess gutta-percha and cement are removed from the pulp chamber and the chamber then sealed with a temporary restoration.

Amalgam or composite materials may be placed to fill the carnal opening and restore the tooth permanently (fig. 7-20). Teeth successfully treated endodontically may also be restored with prosthodontics treatment, such as onlays and artificial crowns. As a rule, follow-up appointments are scheduled periodically for radiographs of the restored tooth. The dentist uses the post-treatment radiograph as an aid to determine the elimination of infection and progress of bone regeneration.

STEPS IN APICOECTOMY (ROOT END RESECTION)

The apicoectomy (root end resection) requires teamwork between the dentist and his/her assistants.

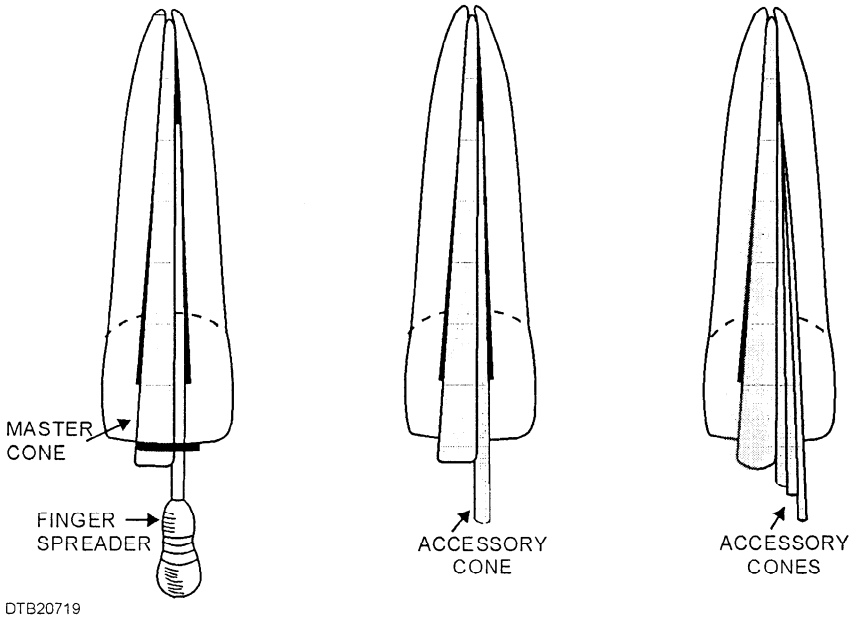


Figure 7-19.—Steps in filling a root canal with master and accessory cones.

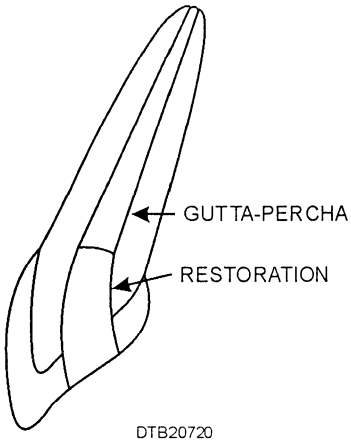


Figure 7-20.—Permanent restoration in place on completed root canal.

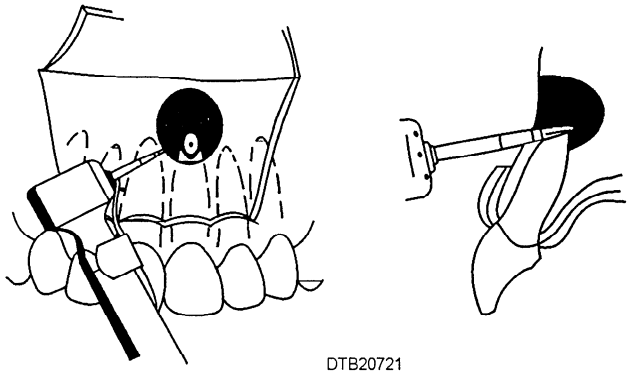


Figure 7-21.—Removing apex of tooth.

Along with the apicoectomy, the dentist usually performs a periapical curettage and may place a retrograde filling. After the patient has been draped and anesthetized, the dentist makes a surgical incision on the facial aspect of the alveolar ridge and a mucoperiosteal flap is elevated to expose the apex of the tooth to be treated. The assistant aids in retraction of the mucoperiosteal flap with the periosteal elevator and provides suction. This reveals the cortical bone of the alveolus covering the apex of the tooth. The dentist then uses a handpiece and surgical bur to remove the cortical plate covering the apex of the tooth. Once the root is exposed, the dentist uses the bur to remove the apex as shown in figure 7-21. The assistant irrigates with a saline solution and aspirates as needed. The dentist uses a curette to curettage the surrounding periapical tissue, thus removing infectious material from around the root tip. Figure 7-22 illustrates the curettage procedure. If access to the canal is obstructed from the occlusal or lingual aspect, debridement and filling can now be done from the apex.

If indicated, a retrograde filling may be performed to seal the apical end of the root canal by placing a

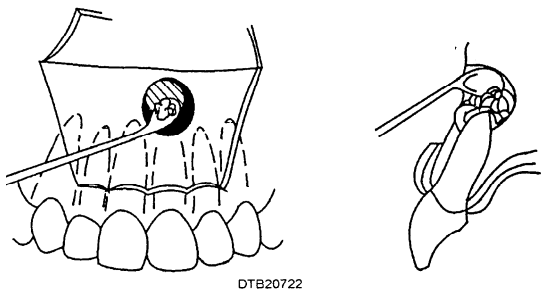


Figure 7-22.—Apical curettage procedure.

restoration in the root apex. The dentist may use an ultrasonic or a high-speed handpiece with a bur to prepare the blunted apex for the filling. When the preparation is complete, the surgical site is irrigated carefully with saline solution and aspirated until it is dried thoroughly. Hemostatic agents such as bovine collagen or ferric sulfate may be placed to control bleeding and to catch scraps during the placement and condensation of the root end filling material. Intermediate restorative material such as ZOE, or super EBA cement (ethoxybenzoic acid) is mixed and placed into the recessed preparation of the root apex. The retrograde filling is condensed and smoothed even with the tip of the amputated root surface. The hemostatic agents are carefully removed to avoid dropping scraps or cement into the incision. The site may be irrigated and aspirated again.

A radiograph is exposed to determine the absence of any filling particles in the tissue at the surgical site. When it is determined that the filling is satisfactory and that all particles of the filling material are removed, sutures are placed to close the incision. The surgical portion of the apicoectomy is done quickly. The longer the patient is subjected to a surgical procedure, the more likely it is that there will be swelling and discomfort. Follow-up appointments usually are scheduled periodically for radiographs of the restored tooth.